maine's sustainability solutions initiative

solutions

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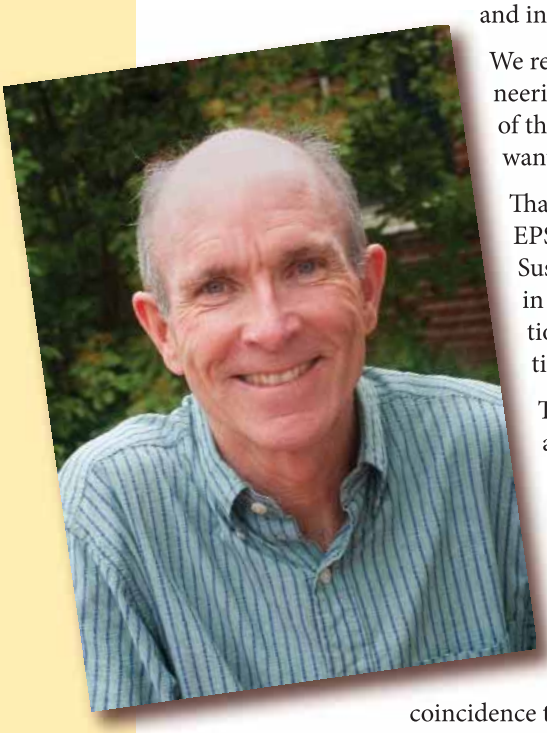
Dear Readers,

Science is pretty good at describing society's problems. Now it needs to do a better job solving them.

As a scientist, I haven't had an easy time admitting this. Yet I think it's the first step toward change. Questioning science's relevance to society also helps explain what brought together an unlikely mix of faculty and innovators at the University of Maine a few years ago.



We represented many fields. Biology and economics. Anthropology and engineering. Communications, forestry, public policy and many more. At the end of the day, we realized we had something amazing in common—we all wanted our research to help solve problems in the real world.

That first conversation led to many more—and to a $20 million, five-year EPSCoR grant from the National Science Foundation to launch Maine's Sustainability Solutions Initiative in 2009. We set out to advance knowledge in the new field of sustainability science, and put that knowledge into action by helping Maine communities solve urgent problems at the intersection of economic, social and environmental issues.

Today, SSI is leading Maine's transition to a sustainable future. We're also among the nation's leaders in sustainability science, with 108 faculty collaborating in 26 interdisciplinary teams. These teams are working on key sustainability issues including renewable energy development, urban planning, water resource management and the future of Maine's North Woods. In collaboration with a wide array of stakeholders, they are helping Mainers identify strategies that can simultaneously create new and better jobs, strengthen communities and protect the environment.

Yes, that's ambitious. It's also, as our T-shirt says, MESSI (maybe it's no coincidence that this is the acronym for Maine SSI). But our researchers value the opportunity to work with communities and recognize that their input is key to truly sustainable solutions. SSI scientists are out on the streets of Eastport and nearby towns listening to residents' needs and concerns to help guide the sustainable development of tidal power. A research team in central Maine is meeting with local organizations to tackle deteriorating water quality in lakes. Another SSI team is collaborating with Maine towns to develop improved strategies for balancing economic development with natural resource protection.

We're also educating students to be the problem solvers of the future. SSI offers opportunities for all levels—post-doctoral fellows, graduate and undergraduate students, and students in grades K-12—to do hands-on problem solving and gain experience in interdisciplinary teamwork. In 2010 alone, nearly 200 students participated in research internships with SSI.

We'll keep you posted on our progress. In the meantime, we hope you enjoy the stories in this, SSI's first newsletter. For more, visit our website at http://www.umaine.edu/sustainabilitysolutions/.

David Hart,
Research Leader, Maine's Sustainability Solutions Initiative
and Director, Senator George J. Mitchell Center

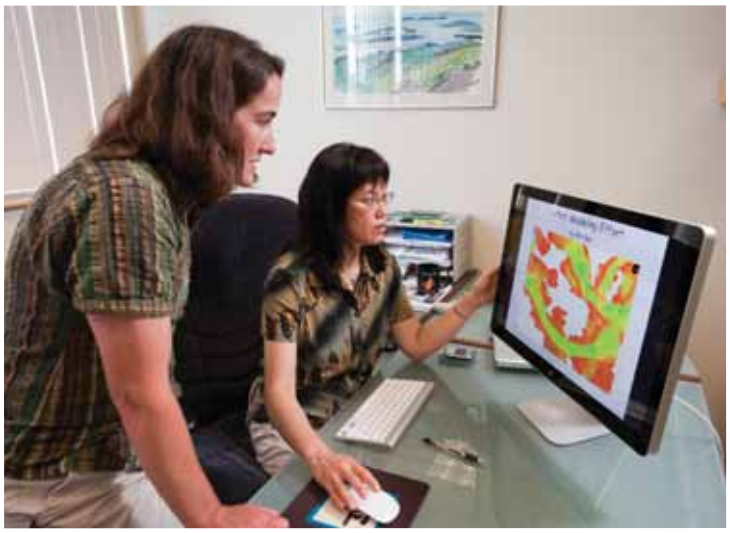
Inside:

Connecting knowledge with action to strengthen our economic, social and environmental future

Tidal Power in Down East Maine

Maine's Cobscook Bay is a hot spot for tidal power. Following a successful demonstration project on the bay last year, an energy company plans to install the first commercial tidal power system in the U.S. to generate electricity with underwater turbines. Making sure this technology is developed sustainably is the goal of an SSI project led by UMaine researchers Gayle Zydlewski and Teresa Johnson as part of the Maine Tidal Power Initiative.

Zydlewski, a fish biologist, and Johnson, a social scientist specializing in fishing communities, are studying the environmental, economic and social issues surrounding tidal power in the communities of Cobscook Bay. They will use their findings to create a model process that other communities can use to make informed decisions about the development of tidal power in local waters.



UMaine researchers Gayle Zydlewski and Huijie Xue study a model of the tides in Cobscook Bay.

The Cobscook Bay area, which includes Eastport, Lubec, Perry, Pembroke and other communities, may be the first region in the U.S. powered in part by tidal power from underwater turbines. Portland-based Ocean Renewable Power Company (ORPC), which generated electricity with prototype turbines in Cobscook Bay last year, plans to install a commercial system by the end of the year that could provide power for 50 to 75 homes in the area. The company plans to eventually scale up the project to provide enough electricity for 1,200 homes and businesses in Maine.

Community participation is central to tidal power development in Maine, according to Johnson and Zydlewski. "We're interested in understanding the human dimensions of tidal power," says Johnson, an assistant professor of marine policy in the School of Marine Sciences. "We want to know what the community's concerns are and what questions they want addressed."

To that end, she and Zydlewski have collaborated with area organizations including the Cobscook Bay Resource Center and the Maine Sea Grant Program to design and conduct an in-depth survey of about 40 key stakeholders ranging from fishermen to regulators and scientists.

The researchers found that stakeholders have two main concerns: how tidal power affects marine life and whether this new technology will bring desperately needed jobs to communities of Cobscook Bay.

To address environmental concerns about tidal power, Zydlewski is collaborating with local fishermen to learn more about fish populations and migrations in Cobscook Bay throughout the year. This information will help determine risks of turbine placement on fish and other marine life. State and federal regulators will then analyze these risks to determine a path forward for the industry.

"As a fish biologist, my interest is in looking at how we can develop tidal power in Maine in an environmentally acceptable fashion," says Zydlewski, an assistant professor in the School of Marine Sciences. "And that dovetails into the idea of how can this be acceptable to fishermen."

Will Hopkins, Executive Director of the Cobscook Bay Resource Center, is among the key stakeholders collaborating on this project. He has witnessed the potential of community members and scientists pooling their expertise to solve problems. "Anytime you can get experienced fishermen, who have lived their lives on the water, together with university researchers, who have the richness of their scientific background, generally, good things happen," he says.

The study involves stakeholders at every juncture, from defining the problems and developing research questions to creating and evaluating solutions—a powerful draw for SSI researchers. "This is a big part of the reason I got involved with SSI," says Zydlewski. "It's very rewarding to interact with people. I don't want to just go in and give a presentation on the work we conducted. I want to be able to engage people and get their feedback so we can learn how to conduct our research so that it is effective for local needs."

This work is timely as tidal power emerges as a promising source of renewable energy. Although the technology is still in its infancy, more than 45 tidal

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—Teresa Johnson

power projects are being proposed around the world, a five-fold increase since 2009, according to IHS Emerging Energy Research, a consulting firm based in Cambridge, Massachusetts. In Maine, energy developers estimate that tidal power could generate up to 400 megawatts of power in a decade.

"It's very rewarding to interact with people... I want to be able to engage people and get their feedback so we can learn how to conduct our research so that it is effective for local needs."
—Gayle Zydlewski

"These technologies are developing very rapidly and there are more companies coming online, so there's a real need for this information," Johnson says of tidal power development. "We hope to document the lessons learned in the Cobscook Bay area so other communities that want to develop tidal power can have a way forward. We want our work to give local communities a voice in the process."

Making sure those voices are heard matters personally to Johnson, a Maine native who returned to her home state after earning a doctorate in human ecology from Rutgers University. "I grew up in a fishing family near Rockland, so I care about fishing communities and coastal communities," she says. "I'd like to see them around for a long time."

ORPC's prototype turbine was designed with assistance from the University of Maine. Photo courtesy of Ocean Renewable Power Company.

SSI in the News

Watch for Us September 27th on MPBN!

SSI is the subject of Sustainable Maine, a forthcoming documentary series on Maine Public Television. The first documentary, The Triple Bottom Line features SSI researchers Teresa Johnson and Gayle Zydlewski, who are collaborating on sustainable tidal power in Eastport, and Jessica Leahy, who is working with small family forest owners on sustainable woodlands. The second episode titled Desperate Alewives features a collaborative SSI research team from Bates and Bowdoin colleges and the University of Southern Maine led by John Lichter (Bowdoin). The team is focused on the ecological and economic recovery of the Androscoggin and Kennebec Rivers and the impact that alewife restoration may play in that recovery.

MPBN will air the first two episodes on September 27th at 8:00 and 8:30pm respectively.

Robert Kates Edits New Reader on Sustainability Science

The field of sustainability science recently took a leap forward with a new online reader edited by SSI advisory board chair Robert W. Kates. Readings in Sustainability Science and Technology provides the first systematic introduction to the key concepts in sustainability science and examples of solutions from around the world. Published by the Center for International Development at Harvard University, the reader can be downloaded at http://www.hks.harvard.edu/centers/cid/publications/faculty-working-papers/cid-working-paper-no.-213.

Risk Communication Expert Delivers Mitchell Lecture on October 13

Baruch Fischhoff, a cognitive psychologist and professor of social and decision sciences at Carnegie Mellon University, will present the 2011 Senator George J. Mitchell Lecture on Sustainability on Thursday, October 13, at 12:00 pm at Wells Conference Center, UMaine, Orono. Fischhoff will discuss his research on using "non-persuasive communication" to explain science to the public in ways that help people make more informed decisions about complex issues.

Fischhoff, whose leadership roles include chairing the FDA's Risk Communication Advisory Committee and serving on the EPA's Scientific Advisory Board and chairing its Homeland Security Advisory Committee, focuses on helping the public understand and respond to health and environmental risks. His research interests include establishing a new interdisciplinary approach to communicating science to the public.

To reserve tickets for this free, public event, call 207/581-3244.

Mapping Maine's Future

It's the same story in many communities across Maine and the nation. Historic buildings sit empty downtown as strip malls proliferate on the outskirts. Former forests and farm fields grow houses instead of timber and food as development spreads helter-skelter. Every errand means getting in the car.

This inefficient development pattern can increase taxes and infrastructure costs and undermine quality of life and ecosystems. Encouraging more sustainable development will require new ways of seeing and doing things. Rob Lilieholm and his colleagues are creating innovative models to help.

The researchers are using a technique called alternative futures modeling to simulate how different land use policies, changing demographics and many other variables will affect the Maine landscape. These models synthesize complex layers of data, including spatial data and expert knowledge from key stakeholder groups, to generate detailed maps that will help identify the best land for various purposes such as development, conservation and protection of working forests and farmland.

Planners, landowners, citizen groups and others can use these maps to evaluate trade-offs and consequences, economic and otherwise, of alternative land uses. Ultimately, the maps will help communities make more informed decisions about the future they're trying to create.

"The idea is anticipating the future to make better land use decisions," says Lilieholm, E.L. Giddings Associate Professor of Forest Policy at UMaine. "These models help people step back and see patterns and trends. It gets them thinking about the big picture and the irreversibility and hidden costs of what we do."

"This research will give us information on what users need from these models and help us ensure that our models are actually used in real-life planning processes."
—Michelle Johnson

Better planning tools are urgently needed as large-scale change sweeps through Maine, altering the landscape and communities. These forces include recent ownership changes in large tracts of forestland in northern Maine in which land is divided into smaller parcels among more owners. This, in turn, can lead to fragmentation. "As the landscape becomes fragmented, even if it stays in forest, it usually becomes less open to recreation, less available as a source of timber, and a lot of things get compromised," Lilieholm says. "The fragmentation process is a pipeline toward development."

At the same time, development pressure is intensifying in the southern half of the state. Private forestland in the lower Kennebec River watershed, for example, is among the most at risk in the nation for conversion to residential development.

SSI graduate students Michelle Johnson and Spencer Meyer discuss conservation areas on a map of the Penobscot River watershed.

Planners and other decision-makers have only limited information to address such challenges, yet the choices they make today will affect the economic, social and environmental future of their communities. The alternative futures models Lilieholm's team are creating will allow users to simulate how different decisions and variables ranging from socio-economic conditions to regulatory climates interact and affect the landscape. This virtual glimpse of possible outcomes can help communities avoid potential negative consequences on the ground and guide development onto a more sustainable path.

Stakeholder input is a key element of these models—and the focus of research by SSI graduate students Spencer Meyer and Michelle Johnson. Meyer is helping to build stakeholder-driven models of land use in Maine, and Johnson will work on making sure the team's models are relevant and used to help solve real-world challenges.

"We want to know from conservationists, foresters, farmers and developers what makes land best suited to their missions," says Meyer, a doctoral student who also is an associate scientist for forest stewardship with UMaine's Center for Research on Sustainable Forests.

"Once we get a better understanding of their needs, we can begin to identify areas where land use pressures will likely overlap."

Throughout the project, Johnson will study how these and other models are used in land use planning and land conservation initiatives. "This research will give us information on what users need from these models and help us ensure that our models are actually used in real-life planning processes," Johnson says.

After they've completed data collection and analysis, Lilieholm's team will pilot test alternative futures models in towns in the Lower Penobscot River Watershed. Bangor is in the heart of this region, where residential development is expected to affect 135,000 acres over the next 20 years, according to a 2009 report by the U.S. Forest Service.

The models also will reveal areas in the watershed where potential land use conflicts may occur, for instance land suited for both development and food production—as well as potential compatibilities where land could be used for multiple purposes such as timber production and outdoor recreation. Such information can help planners locate new development near existing roads, schools, shopping areas and other infrastructure, and more strategically conserve land important for a variety of purposes such as wildlife habitat, wetlands protection and recreation. "This approach is not just common sense—it makes economic sense as well," Lilieholm says.

The opportunity to help solve real-world problems through interdisciplinary collaboration inspired both Johnson and Meyer to do their doctoral work with SSI. They say this combination is rare in scientific research.

"I chose SSI because I know that PhD work can be isolating," says Johnson, a natural resource planner interested in sustainability issues in land use. "I wanted to have a community to be a part of, and I wanted the questions I ask from my own research to be situated within a larger context."

Meyer, who has worked on sustainable forest management with large landowners in Maine, also wanted to collaborate with a diverse team of researchers. "Through SSI, I have the chance to work with impressive researchers and communicators. This kind of cross-discipline work is not very common in research," he says. Meyer adds that he recently sat down to discuss "hot topics" in land use planning with colleagues in economics, communications, urban planning and biology. "And I'm a forester," he says. "We were really all on the same page. That's pretty amazing."

Student Spotlight: Spencer Meyer

A native New Englander, Spencer Meyer has a passion for the natural world and an appreciation for the interconnections between people and the places where they live. He recently decided to combine his personal interests and professional expertise to pursue a PhD through SSI.

After working for years with large landowners on sustainable forest management in Maine, Meyer is examining the bigger picture of landscape conservation as a member of SSI's Alternative Futures Team. He's building stakeholder-driven models of land use in Maine that could someday help communities make more sustainable choices amid pressures ranging from development to rising fossil fuel prices.

There are no easy answers, of course, but Meyer appreciates the chance to work on viable solutions in his own back yard. "I love Maine," says Meyer, who enjoys biking, hiking and skiing around the state with his wife and young son. "I've been here for almost a decade and I didn't see any reason to leave, since the opportunity I wanted was right here."

SSI at a Glance:

In our first two years, we've built capacity and connections with institutions of higher learning, stakeholders and communities throughout Maine. Today, SSI researchers are working on more than two dozen projects around the state focused on advancing economic and community development while protecting our environment. Here's a brief look at the numbers for 2010.

- 108 Faculty researchers
- 26 Interdisciplinary research teams
- 13 Participating Maine universities and colleges
- 148 Stakeholder organizations
- 1,709 Participants indirectly supported through outreach, workforce development, and collaborative activities
- 343 Individuals receiving direct support, including:
  - 115 New positions
  - 48 Graduate student internships
  - 144 Undergraduate student internships
  - 21 High school student internships
- 36 Articles published in peer-reviewed journals
- 100+ Presentations at professional conferences

Sustaining Our Lakes

Maine's 5,700-plus lakes pump an estimated $2.5 billion into the state's economy every year, according to the report *The State of Maine's Environment 2010*. But human activity is reducing water quality in many of our lakes, which affects everything from property values to tourism dollars to fish.

The Belgrade Lakes region is a crucible for these pressures—and an ideal place to learn how to contend with them. Interdisciplinary teams of faculty and students at Colby College and the University of Maine at Farmington are doing exactly that in an SSI project led by Colby chemistry professor D. Whitney King.

The researchers are studying the effects of development on lake water quality and local economies in the Belgrade Lakes region, an important economic engine in central Maine that includes 7 major lakes and 13 communities. They are focusing on a widespread and tricky problem: phosphorus pollution from development and other human activity.

Colby undergraduate student Sylvia Doyle conducts a shoreline survey of Great Pond in the Belgrade Lakes region.

A natural component of soils and a common ingredient in chemical fertilizers and detergents, phosphorus washes into lakes in runoff from yards, roads and faulty septic systems. Too much phosphorus "over-fertilizes" lakes, speeding up the natural aging process called eutrophication—sometimes with serious consequences.

In the worst cases, lakes become fouled with unchecked algae blooms that can harm fish and other aquatic life, interfere with recreation and affect property values. A 1996 University of Maine study reported that property values drop as much as 10 to 20 percent with every meter decline in water clarity.

Several of the Belgrades are among the more than 50 Maine lakes that have experienced recurrent algal blooms and the nearly 500 more at risk. The problem is likely to worsen statewide as more lakeshore is developed, further increasing the risks for erosion and phosphorus pollution.

King and his colleagues are using the Belgrade region as a model to create new strategies to remediate and restore lake water quality, anticipate and address future changes in the watershed, prevent further pollution and engage communities and landowners in becoming part of the solution. The team's solutions are based on a three-pronged approach: figuring out the main sources of eutrophication in the Belgrades, evaluating the best practices to keep phosphorus runoff out of the lakes, and finding the most effective ways to encourage homeowners to help through such measures as controlling erosion on shorefront property.

The researchers will share their findings with communities and stakeholder groups including the Maine Congress of Lake Associations and the Belgrade Regional Conservation Alliance (BRCA) to educate the public about protecting the lakes. "Local stakeholders are willing to change land use practices if they have access to well-tested conservation models and are motivated by community leaders," King says.

That access will improve dramatically when the Maine Lakes Resource Center opens in Belgrade Village this summer—the culmination of a campaign called "Docks to Doorways" in which community members and stakeholder organizations raised $2.5 million to restore historic docks, create green space and build an education center. The new center will educate landowners and visitors about best practices for protecting lakes, such as planting rain gardens to absorb runoff, building buffer strips of vegetation along shorelines and using porous paving materials.

Mel Croft, BRCA president, says the new center will help bring years of hard work to fruition. "Much progress has been made," he says, "but we hope a more concentrated effort will decrease the decline of water quality and eventually reverse this trend."

Input from community stakeholders like BRCA is key to developing truly sustainable solutions, King observes. "Community engagement in the research process takes a lot of time, but the outcomes can be much more significant than traditional research programs," he says. "It's important to define outcomes to include changes in how people interact with lake ecosystems in addition to the generation of scientific knowledge."

"Local stakeholders are willing to change land use practices if they have access to well-tested conservation models and are motivated by community leaders."
—Whitney King

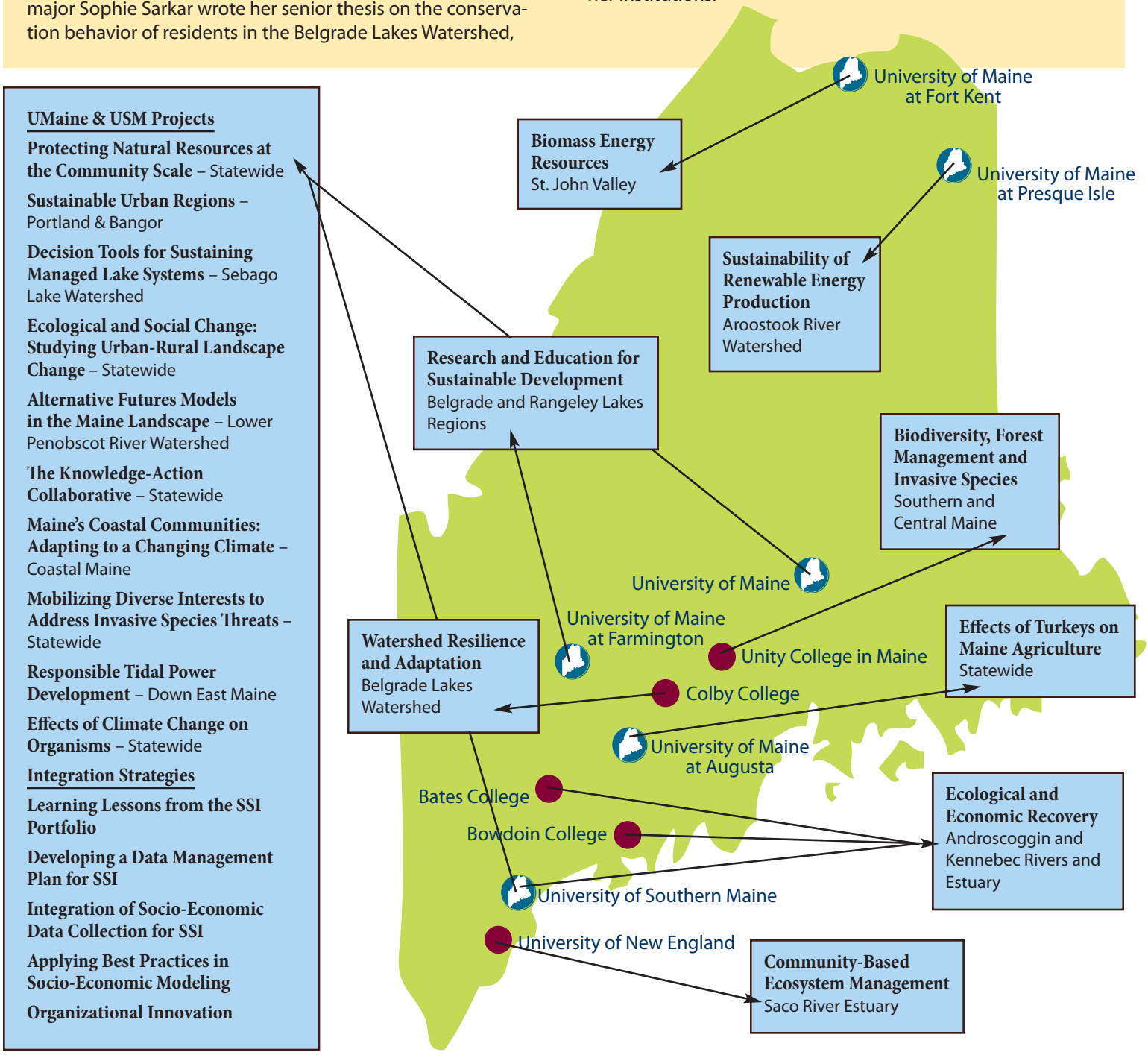
SSI Partner Institutions

Colby College is one of 11 institutions of higher learning in Maine collaborating on the SSI project. This unprecedented partnership helps support sustainability science research at undergraduate colleges and universities around the state. It also gives students opportunities to work with interdisciplinary research teams led by faculty from a wide range of fields.

Students are key collaborators on all research teams. As part of the Colby team, environmental policy and economics major Sophie Sarkar wrote her senior thesis on the conservation behavior of residents in the Belgrade Lakes Watershed, with the guidance of Philip Nyhus, Colby associate professor of environmental studies.

Sarkar told the Colby Echo that her thesis focused on "the knowledge and economic variables to determine how and why people value the lakes on which they live, including their willingness to pay for improved lake water quality."

Such research, which will contribute to the understanding of social and economic issues surrounding water quality, is just one example of integrated educational activities led by partner institutions.



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